

10.1.4 Calibration of flowmeters. The calibration of flowmeters is necessary to ensure that an equal volume of sampled gas is entering each of the individual cassettes and that no large differences, which could possibly bias the sample, exist between the cassettes.

10.1.4.1 Variable area, 65 mm flowmeters or equivalent shall be used. These flowmeters can be mounted on a common base for convenience. These flowmeters shall be calibrated by attaching a prepared cassette, complete with filters and pads, to the flowmeter and then to the system manifold. This manifold is an aluminum cylinder with valved inlets for connections to the flowmeters/cassettes and one outlet to a dry gas meter. The connection is then made to the wet-test meter and finally to a dry gas meter. All connections are made with tubing.

10.1.4.2 Turn the dry gas meter on for 15 min. in preparation for the calibration. Turn the dry gas meter off and plug the intake hole of the cassette. Turn the dry gas meter back on to evaluate the entire system for leaks. If the dry gas meter shows a leakage rate of less than 0.02 ft³/min at 10 in. of Hg vacuum as noted on the dry gas meter, the system is acceptable to further calibration.

10.1.4.3 With the dry gas meter turned on and the flow indicator ball at a selected flow rate, record the exact amount of gas pulled through the flowmeter by taking measurements from the wet test meter after exactly 10 min. Record the room temperature and barometric pressure. Conduct this test for all flowmeters in the system with all flowmeters set at the same indicator ball reading. When all flowmeters have gone through the procedure above, correct the volume pulled through each flowmeter to standard conditions. The acceptable difference between the highest and lowest flowmeter rate is 5 percent. Should one or more flowmeters be outside of the acceptable limit of 5 percent, repeat the calibration procedure at a lower or higher indicator ball reading until all flowmeters show no more than 5 percent difference among them.

10.1.4.4 This flowmeter calibration shall be conducted at least once per year.

10.1.5 Miscellaneous equipment calibrations. Miscellaneous equipment used such as an automatic recorder/ printer used to measure dry gas meter temperatures shall be calibrated according to the manufacturer's specifications in order to maintain the accuracy of the equipment.

11.0 Analytical Procedure

11.1 The preferred primary analytical determination of the individual isolated samples or the combined particulate and gaseous samples shall be performed by an automated methodology. The analytical method for this technology shall be based on the manufacturer's instructions for equipment operation and shall also include the analysis of five standards with concentrations in the expected range of the actual samples. The results of the analysis of the five standards shall have a coefficient of correlation of at least 0.99. A check standard shall be analyzed as the last sample of the group to determine if instrument drift has occurred. The acceptable result for the check standard is 95 to 105 percent of the standard's true value.

11.2 The secondary analytical method shall be by specific ion electrode if the samples are distilled or if a TISAB IV buffer is used to eliminate aluminum interferences. Five standards with concentrations in the expected range of the actual samples shall be analyzed, and a coefficient of correlation of at least 0.99 is the minimum acceptable limit for linearity. An exception for this limit for linearity is a condition when low-level standards in the range of 0.01 to 0.48 µg fluoride/ml are analyzed. In this situation, a minimum coefficient of correlation of 0.97 is required. TISAB II shall be used for low-level analyses.

12.0 Data Analysis and Calculations

12.1 Carry out calculations, retaining at least one extra decimal point beyond that of the acquired data. Round off values after the final calculation. Other forms of calculations may be used as long as they give equivalent results.

12.2 Estimating volumes for initial test runs.

$$F_v = \frac{(F_d)(X)}{F_e}$$

Eq. 14A-1

Where

F_v = Desired volume of dry gas to be sampled, ft³.

F_d = Desired or analytically optimum mass of TF per cassette, micrograms of TF per cassette (µg/cassette).

X = Number of cassettes used.

F_e = Typical concentration of TF in emissions to be sampled, µg/ft³, calculated from Equation 14A-2.

$$F_e = \frac{(R_e)(R_p)(4.536 \times 10^8 \mu\text{g/lb})}{(A_r)(V_r)} \quad \text{Eq. 14A-2}$$

Where

R_e = Typical emission rate from the facility, pounds of TF per ton (lb/ton) of aluminum.

R_p = Typical production rate of the facility, tons of aluminum per minute (ton/min).

V_r = Typical exit velocity of the roof monitor gases, feet per minute (ft/min).

A_r = Open area of the roof monitor, square feet (ft²).

12.2.1 Example calculation. Assume that the typical emission rate (R_e) is 1.0 lb TF/ton of aluminum, the typical roof vent gas exit velocity (V_r) is 250 ft/min, the typical production rate (R_p) is 0.10 ton/min, the known open area for the roof monitor (A_r) is 8,700 ft², and the desired (analytically optimum) mass of TF per cassette is 1,500 μg . First calculate the concentration of TF per cassette (F_e) in $\mu\text{g/ft}^3$ using Equation 14A-2. Then calculate the desired volume of gas to be sampled (F_v) using Equation 14A-1.

$$F_e = 20.855 = \frac{(1.0 \text{ lb/ton})(0.1 \text{ tons/min})(4.536 \times 10^8 \mu\text{g/lb})}{(8,700 \text{ ft}^2)(250 \text{ ft/min})} \quad \text{Eq. 14A-3}$$

$$F_v = 575.40 \text{ ft}^3 = \frac{(1,500 \mu\text{g})(8 \text{ cassettes})}{(20.855 \mu\text{g/ft}^3)} \quad \text{Eq. 14A-4}$$

This is a total of 575.40 ft³ for eight cassettes or 71.925 ft³/cassette.

12.3 Calculations of TF emissions from field and laboratory data that would yield a production related emission rate can be calculated as follows:

12.3.1 Obtain a standard cubic feet (scf) value for the volume pulled through the dry gas meter for all cassettes by using the field and calibration data and Equation 5-1 of Method 5 of this appendix.

12.3.2 Derive the average quantity of TF per cassette (in $\mu\text{g TF/cassette}$) by adding all laboratory data for all cassettes and dividing this value by the total number of cassettes used. Divide this average TF value by the corrected dry gas meter volume for each cassette; this value then becomes TF_{std} ($\mu\text{g/ft}^3$).

12.3.3 Calculate the production-based emission rate (R_e) in lb/ton using Equation 14A-5.

$$R_e = \frac{(\text{TF}_{\text{std}})(V_r)(A_r)(2.2 \times 10^{-9} \text{ lb}/\mu\text{g})}{(R_p)} \quad \text{Eq. 14A-5}$$

12.3.4 As an example calculation, assume eight cassettes located in a potline were used to sample for 72 hours during the run. The analysis of all eight cassettes yielded a total of 3,000 μg of TF. The dry gas meter volume was corrected to yield a total of 75 scf per cassette, which yields a value for TF_{std} of 3,000/75=40 $\mu\text{g/ft}^3$. The open area of the roof

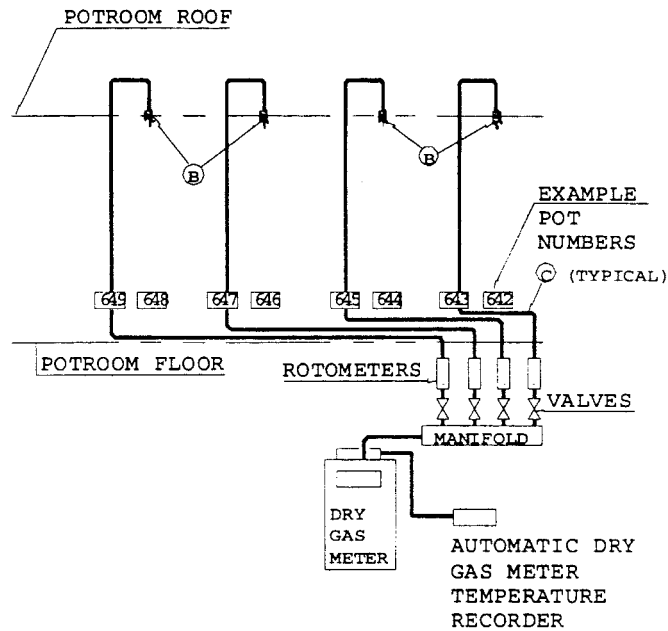
monitor for the potline (A_r) is 17,400 ft². The exit velocity of the roof monitor gases (V_r) is 250 ft/min. The production rate of aluminum over the previous 720 hours was 5,000 tons, which is 6.94 tons/hr or 0.116 ton/min (R_p). Substituting these values into Equation 14A-5 yields:

$$R_e = \frac{(5 \mu\text{g}/\text{ft}^3)(250 \text{ ft}/\text{min})(17,400 \text{ ft}^2)(2.2 \times 10^{-9} \text{ lb}/\mu\text{g})}{(0.116 \text{ ton}/\text{min})} \quad \text{Eq. 14A-6}$$

$$R_e = 0.41 \text{ lb}/\text{ton of aluminum produced.} \quad \text{Eq. 14A-7}$$

12.4 Corrections to volumes due to leakage. Should the post-test leak check leakage rate exceed 4 percent as described in section

8.3.2 of this method, correct the volume as detailed in Case I in section 6.3 of Method 5 of this appendix.



- ⓑ ALCAN CASSETTE EXAMPLE METHOD SAMPLING POINTS
 ⓒ POLYETHYLENE TUBING ENCLOSED IN CONDUIT

Figure 14A-1. Conceptual side view of arrangement of 4 cassettes for one-half of a potroom.

Note: This drawing does not reflect an equally acceptable arrangement of 8 cassettes in a cassette group located along at least 8 percent of the potroom roof.